FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE

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INTRODUCTION

Our environment increasingly demands more palliatives and solutions to its perturbations. This paper surveys some of the most recognizable and pressing problems of the environment, and includes comments on them from the current literature. RAND's deepening involvement in these studies will undoubtedly focus on issues presented here.

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CONTENTS

WEATHER MODIFICATION BY SST AND STRATOSPHERIC AIR FORCE PLANES

Will the exhaust of the SST and AF stratospheric fighter-bombers in the light of present knowledge affect the weather?

Will particulates such as slowly evaporating ice crystals appreciably reduce the influx of sunlight as did the Balinese volcano Agung in 1963 (15% reduction in solar constant over lower half of northern hemisphere for 18 months).

(1) how rapidly should ice evaporate at 70,000 feet?

(2) will NO produced (~1000 ppm) seriously catalyze ozone production in stratosphere and thus absorb sunlight and change the level of the stratosphere?

Item: Nature 226, 71, 1970, April 4, "Water Vapor Pollution in the Stratosphere by the Supersonic Transporter." "Four hundred supersonic transporters, flying in the stratosphere, would inject about 150,000 tons of water per day. This injection rate is similar to that brought about by atmospheric motion.... Additional water vapor may alter the stratosphere in several ways. Study indicates that stratospheric temperature decreases when water vapor content increases. The aircraft also introduce CO_2, and that has also been found to lower the temperature. A change in the cloudiness of the stratosphere can be anticipated. Other pollutants from the supersonic transporter may terminate as aerosols. Aerosol residence times in the stratosphere are much longer than in the troposphere (several months in the lower stratosphere; several years at 30 km)...." by R. E. Newell.

Item: N. Y. Times, May 8, 1970, "Rep. Reuss assails superjet as peril to the environment." "Representative Henry Reuss, Democrat of Wisconsin, said today that the supersonic transport would be an environmental outrage.... Millions pay for this folly in the form of increased airport noise, sonic booms, air pollution and weather changes! Environmental problems posed by the plane are extremely serious and have not been solved. Dr. Richard Garwin recommended immediate termination of the U.S. Government's support of the supersonic program...."

Item: N.Y. Times, May 12, 1970, pg. 78, "U.S. SST Commitment May Increase by $3 Billion," "James Beggs, Undersecretary of Transportation, said he would ask for government backed loans to start production of the SST if private financing were unavailable. The decision to ban supersonic flights over land because of the sonic boom makes it doubtful, Dr. Richard Garwin said, that 500 SST's can be sold. The SST's runway noise would be the equivalent of 50 jumbo jets taking off at once."

Item: N.Y. Times, May 28, 1970, pg. 23, "Navy baloon flights have shown that humidity in the stratosphere has risen 50% during the last 6 years. While the cause of the rise is unknown, it is assumed to be of natural origin, since there is now virtually no air traffic within the stratosphere. Proponents of the SST are taking the finding of such large natural fluctuations as evidence that water vapor added by SST's would not have a serious effect on climate. An Air Force scientist has found that when SST traffic reaches its peak, exhaust particles will be of smaller concentration than levels that persist there for a year or more following large volcanic explosions. The balloon flights, carried out by H. J. Mastenbrook of NRL, show a steady increase from 2 ppm of water to 3 ppm today in stratospheric air. This 50% rise is far greater than the long term 7% rise from SST traffic foreseen by a 1966 panel of the National Academy of Science. Dr. S. Manabe, Princeton, believes that a water molecule remains in the lower stratosphere for one year, and three years in the upper. Dr. F. E. Volz, Air Force Cambridge Research Labs., believes that dust from SST's would reduce incidence of sunlight by 1%, far less than resulted from Krakatoa in 1883. The Agung explosion of 1963 cut sunlight in the southern hemisphere by 15%. Dust from Agung crossed the equator and raised stratospheric dust levels nine-fold in northern mid-latitudes. Dr. Volz concludes that dust has a residence time of one year in the stratosphere. Among uncertainties of the SST exhaust is the fear that its water vapor will react with oxygen and prevent formation of the ozone layer which now absorbs lethal ultraviolet sunlight. Dr. Julius London, NCAR, concludes that this effect would be small...."

CONSTRUCTIVE USE OF HEAT POLLUTION

Item: N. Y. Times, Feb. 27, 1970, "Florida Power Plant Told to Cool Water." "Acceptable rise of bay water temperatures no more than 1.5 degrees in summer or 4 degrees in winter and discharge temperature not to exceed 90 degrees (Fahrenheit)." "Florida Power and Light Company was given 60 days to come up with proposals for an alternative."

Item: N. Y. Times, March 4, 1970, "U.S. Suit Fights Heat Pollution." "Micro and other small organisms were killed as the sea water passed through the heat exchangers. When discharged into the bay these dead organisms had a visible destructive effect on marine ecology--water equivalent to all of Biscayne Bay would pass through the plant in less than a month--removal of micro life will destroy the existing ecological cycle." Problem: to study acceptable solutions to cool the electric power plants without damage to the ecological structure of Biscayne Bay; to recommend use of "heat pollution" so that it becomes an economic asset, as for example: Item: The Economist, January 24, 1970, "On Flat Fish Farm, if fish can be farmed as poultry now are, they obviously ought to be--flatfish live in captivity at a density well over one thousand times as high as they do under natural conditions--in experimental tanks using the warm water effluent of the Hunterston nuclear power station, plaice have been grown to marketable size within 18 months."

Item: N. Y. Times, March 8, 1970, "The method that is enabling the (oyster) industry's revival was perfected by...H. Butler Flower... President of Frank M. Flower and Sons of Oyster Bay. Mr. Flower's oyster plant...contains tanks...filled with warm water and nutrients. The oysters are raised for about two months in tanks, then are transplanted.... The cost of keeping the water at constant temperature... makes his method expensive.... Another company, L. I. Oyster Farms, has been using the warm water released at the L. I. Lighting Plant in Northport to grow seedling oysters--at considerable savings in fuel.... The plant is beginning large scale production of the artificially cultivated oysters."

Item: N. Y. Times, May 8, 1970, pg. 1, "Ban on Thermal Pollution is Set for Lake Michigan." "The Federal Water Quality Administration today announced a policy that would forbid the dumping of virtually any heated water into Lake Michigan. If enforced the policy would require the seven planned power plants on the shores of Lake Michigan to cool their discharge water to within a degree of the lake's temperature at that moment. It would also force scores of big industries and hundreds of municipalities that now dump water into the lake either to stop or to treat their discharges first...."

Item: Wall Street Journal, May 21, 1970, "Columbia Gas to Regasify Liquified Gas from Abroad." "Columbia Gas became the first U.S. utility to sign up for long-term supplies of liquified natural gas that will be imported from Algeria. Its Maryland facility will revaporize about one billion cubic feet of dry gas daily. Columbia gas asserted the facility doesn't pose air or water pollution problems other than a lowering of water temperature. The utility has retained Jon M. Linberg and Ruth Patrick to conduct ecological studies on the proposed site...."

Problem: Can gas reliquification plants be sited together with power plants in such a way that the temperature rise induced in cooling water by the latter is cancelled, i.e. equalized, by the temperature drop induced by the former?

Item: N. Y. Times, May 13, 1970, pg. 1, "State Sues Con Ed to Protect River," "The state has charged Con Ed with serious violations of conservation laws and asked that the plant be closed until suitable methods to protect the Hudson River can be developed. According to Con Ed, the Indian Point plant is counted on to produce about 3% of the total power...(about 285,000 Kw).... As far back as 1966, Con Ed's operations at Indian Point drew complaints of fish kills and damage to the ecology of the river...."

Item: N. Y. Times, May 13, 1970, pg. 8, "5-State Power Cut is Result of Heat." "About 20 million electric power consumers served by a power pool in five states--Pennsylvania, New Jersey, Maryland, Virginia and Delaware--and the District of Columbia were affected

yesterday by a 5% voltage reduction as a precautionary measure because of hot weather...."

DDT; WITH IT OR WITHOUT IT

As DDT is withdrawn from use as a pesticide and for use to control malaria and yellow fever, and other degradable but necessarily more lethal chemical substitutes are used, what will be the effect on native animal, bird, fish and insect populations, and on the human population either accidentally or chronically exposed to contamination. What will be the effect on the human population as a result of build-up of resistant disease-carrying insect and animal populations. What will be the effect on plant life as a result of build-up of resistant disease-carrying insect populations. What will be the likely number of yearly events in which sudden rainstorms rinse lethal pesticides, before they have bio-degraded into ineffectiveness, into local water bodies killing the local water life (as happened on the Rhine in 1969 when pesticides were accidentally dumped). Can one reach an advisory position whether continued use of DDT is more or less harmful than use of more lethal but biodegradable pesticides over periods of 1 year, 2 years, 10 years, etc...."

Item: N. Y. Times, February 8, 1970, "Gypsy Moth Threat to Eastern Forests Linked to DDT Cut." "The gypsy moth is infiltrating forests as far south as Virginia and threatening future supplies of wood products...an estimated total of from $2 million to $4 million a year in damage to timber stocks...might soon spiral considerably higher.... Until about 10 years ago widespread use of DDT curbed the moth's population growth and prevented it from traveling South of New Jersey. But there were complaints about DDT residue in dairy products as well as reports of harmful effects on...wildlife species...."

Item: Air and Water News, February 23, 1970, "Wisconsin Bans Use of DDT." "The law prohibits sale and use of DDT for any purpose except control of epidemic diseases affecting humans, plants or animals and which are spread by insects which can be effectively controlled by DDT and not other pesticides...."

Item: N. Y. Times, May 14, 1970, "DDT Production Banned in Soviet." "The Ministry of Agriculture banned today the further production of DDT...[and] said it was taking steps to restrict use of other pesticides including zinc phosphides.... It seemed that the Ministry was not ordering a ban on the use of DDT already in stock.... The U.S. Government announced last November chat it planned to phase out most domestic uses of DDT over a two-year period. It began by ordering the halt of the use of DDT in residential areas by the end of 1969. The order affected all DDT uses for shade trees, pests in aquatic areas, house and garden pests, and tobacco pests, currently using 35% of the total DDT used in this country. Two months ago the Agriculture Department banned aldren and dieldrin in wet areas...."

ENVIRONMENTAL ASPECTS OF NEW HOUSING TECHNIQUES

Item: N. Y. Times, February 27, 1970, "Romney Selects Housing Designs; 22 Systems Aimed to Spur Mass-Produced Homes." "Both high and low rise systems, will be built in 10 selected cities (previously announced) around the country starting early next summer. How will these systems, in mass production at the designated sites in the designated cities, affect transportation, park and garden land, communications, water usage, sewage disposal, future airport siting, future factory siting, smog production (from heating methods proposed for these systems), food supply, supply of electricity, recreation facilities, etc. locally available? Are these 22 systems earthquake proof or earthquake resistant? Are they being built on seismically inactive areas; is the soil base mechanically sound?"

Item: Los Angeles Times, January 18, 1970, "Pollution Can Increase Snowfall." "Heat and pollutants in Buffalo and other metropolitan areas along Lake Erie may play a role in increasing severity of snowstorms along the lakeshore line, government weather researchers say."

Item: Wall Street Journal, November 31, 1969, "Air Pollution is Altering the Weather." "When steel output goes up in Gary, more rain comes down on La Porte--4% more rain fell (downwind) of Chicago and the mills...."

Item: Chemical and Engineering News, March 9, 1970, "Changes in the markets for construction materials are likely to evolve...the 22 systems...can't help but boost demand.... Out of the 22 complete housing systems, seven use concrete, six wood, five employ metal for structural framing, two use plastic foam-core panels or modules, and two use glass fibre and plastics. Mr. Romney observes that this selection represents a shift from potentially scarce wood...and he specifically singles out Material Systems Corporation and TRW Systems groups' use of plastics...."

Problem: Analyze effects on the economy of the Pacific Northwest (a region of few industries) and on the entire country of a massive housing program using these 22 new kinds of low cost building materials. How will mass produced additions to existing cities affect the local weather? Estimate heat and water vapor output from the new suburbs, from house heating, cooking and air conditioning, sewage bacteria, and garden watering.

AIRPORTS FOR LONG ISLAND

Item: N. Y. Times, March 13, 1970, "Planned Expansion of Kennedy Airport into Great South Bay." What will happen to silting in Great South Bay, currents which carry out to sea sewage and land drainage waters? What will happen to fish and crab populations as a result of change in bay temperatures? Great South Bay is one of the major (and few) water bird wintering areas and spring and fall resting areas for migratory birds. Will their food supply (fish, jelly fish, crabs and seaweed) be upset by land expansion and resulting changes in water temperatures and currents? Will the increased plane traffic, radar beams, and noise affect their populations? How will growth of the airport affect sewage disposal, communications, commissary supplies, recreational use of bay waters, water and electrical supply? How will increased smog and kerosene vapors affect natural plant and animal life of Long Island?

Item: N. Y. Times, March 7, 1970, "Floyd Bennett Socked in by Controversy." "Governor Suggests Housing for Site.... City Disagrees.... The Defense Department announced it would relinquish Floyd Bennett Field by the end of June 1971. Governor Rockefeller promptly announced that he would offer a plan for a massive new community on the vast site.... City officials favor adding the area to the Gateway National Recreational Area.... Airline officials favor a plan to transform Floyd Bennett into a mammoth center for air, sea, and land cargo as part of an ambitious plan to expand Kennedy airport across Jamaica Bay."

What is the best use of this large piece of land on western Long Island? Lying as it does in Jamaica Bay, in recreational and wildlife refuge waters, lying as it does on the approach path to two of Kennedy's main runways, a study of the area and its relation to congested Long Island and congested Manhattan is appropriate before committing it to homes for 200,000 people.

DESIGN OF SATELLITE-CITY SYSTEMS FOR THE EAST AND WEST COASTS OF THE USA

Item: N. Y. Times, March 10, 1970, "Tokyo Bay Viewed as a Satellite City.... Plan to Spread Population.... Many of Japan's large cities are growing too fast for their residents to enjoy.... The government is launching an ambitious program to reverse the population migration from rural areas.... New cities will be built and smaller towns expanded, while industry will be encouraged to move away from Tokyo, Nagoya, and Osaka whose populations swelled by almost 10 million between 1955 and 1965.... The government plans to develop great urban spheres to prevent the concentration of factories...and encourage dispersal of population...54 spheres with populations of between 300,000 and one million will be organized... on land to be reclaimed from Tokyo Bay...a second satellite city is being planned to relieve the congestion in the Osaka-Kobe area...." Should satellite cities be planned for both USA coasts? Transportation system, manufacturing centers, goods distribution systems, communication systems, water, power, education, parks, recreation, all should be designed to disperse our crowded centers of population. Can this be the best way to cure slums?

Problem: Design and site satellite cities between Los Angeles, San Diego, San Francisco and Sacramento, and likewise on the east coast of the U.S. to settle 30 million more people in the next 10 years.

STUDY OF RESPIRATORY DISEASES AND THEIR INCIDENCE AS RELATED TO SMOG, IN THE CITIES OF THE WORLD

Item: N. Y. Times, March 12, 1970, "500% Rise in Emphysema Deaths in Last Decade Reported for City." "Despite the overwhelming statistical evidence that air pollution sickens and kills, there is little solid medical proof that specific pollutants cause specific diseases.... Dr. Ernest Wynder...doubts that air pollution plays a major role in the growing incidence of lung cancer.... Excess deaths occur most often in New York, whose air is the dirtiest in the U.S. and second only to London's.... New York's level of sulfur dioxide is half again as high as that of Chicago...."

Sufficient difference of opinion and lack of knowledge exists that a world survey of cities, their air pollution, and incidence of respiratory diseases would bring new discoveries about effect of man's atmospheric environment. Does air conditioning help? as for example in Houston, where air conditioning is ubiquitous.

Problem: Survey and compare all existing information on respiratory diseases in cities of the world. Relate to local smog, local gaseous effluent from fossil fueled power plants, smelters, and chemical factories. Recommend atmospheric standards and safety factors.

SURVEY OF RADIOACTIVE WASTE DISPOSAL METHODS FOR PRESENT AND FUTURE NUCLEAR POWER REACTORS

Item: N. Y. Times, March 7, 1970, "A.E.C. Scored on Storing Waste." "Study prepared in 1966 by Science (National Academy of Science) Panel...disposing of intermediate and low-level liquid--and solid wastes...although momentarily safe, will lead in the long run into serious fouling of man's environment.... Although the AEC is putting the waste into the ground...it does not necessarily intend to leave it there.... 'We intend to do different things with these wastes'...."

How best to use the valuable energy being emitted from these residues and how best to use the valuable chemicals in them? Can they be cast into building blocks for pavements and floors that would stay warm and ice-free all winter? Can they be used to heat cities? Can they be used for "cooking" manufacturing, or stored in central depositories to heat water for a whole city?

CONSTRUCTIVE USE OF GARBAGE

Item: N. Y. Times, March 15, 1970, "Eisenbud Suggests Recycling of Newsprint to Cut Pollution." "A public subsidy be provided to pay for recycling of certain refuse.... Newsprint now generally goes to junk heaps but might be salvaged for about $40 a ton.... Save timber and might also reduce water pollution caused by newsprint mills.... Closing of newsprint mills might throw workers out of job...." What are the pros and cons of reuse of newsprint, and are there better uses for old newspapers other than reuse?

Item: Los Angeles Times, March 22, 1970, "Dr. Andrew Porteus... believes that by turning garbage into alcohol, authorities have a way to recoup at least part of the cost and achieve efficient garbage destruction...hydrolyzing cellulose...which will produce ethyl alcohol.... The process was used...during the war.... Porteus says his process promises to double the output and reduce the time...from three hours to just over one minute. Already...being studied...by the U.S. Public Health Service." How about acetone and other alcohols, aldehydes, acids of commercial value?

Item: Technology Review, February 1970, "Bacterial Cattle Feed from Garbage?" "In nature cellulose produced by plants is broken down by bacteria and thus re-enters the food cycle.... General Electric is studying bacteria to see whether the same kind of process can be used to convert garbage into animal feedstuffs.... Bacterial conversion of cellulose already occurs in the stomachs of ruminants, and Dr. Bellamy uses the rate in this natural process as a criterion for economic feasibility of any artificial system...."

Problem: Survey all similar suggestions for use of garbage and newsprint and recommend recycling systems.

COSTING STUDY OF INDEMNITY PAYMENTS BY INDUSTRIAL AIR POLLUTERS

Item: N. Y. Times, February 28, 1970, "Industrial Pollution a Problem for Some Dutch Tulip Growers." "The pollution problem comes when...haze drifts in from the Royal Dutch Blast Furnaces and Steelworks three miles away.... With it is an invisible-airborne chemical...from fluorspar, a mineral imported from Communist China for mixing with molten iron.... The steelmen have agreed to cut the amount of the chemical, hydrogen fluoride, that reaches the air.... The new ailment threatened to reduce the bulb crop, cutting it by 10%...indemnity payments...have approached $200,000 in a bad year.... In recent years, thanks largely to precautions taken by the steelworks, compensations have been held close to $10,000 per year.... Townspeople too have come to fear the blue haze...."

Problem: to survey the main air pollutants and design a method of assessing fines on polluters in proportion to the damage caused by them.

Item: N. Y. Times, March 3, 1970, "Mobile Lab Helps Detect Polluters." "Since the passage of a new administrative code in September 1963, the city has levied a surcharge on all concerns dumping industrial wastes into the sewer systems.... Companies are assessed according to how much is discharged and the estimated cost to the city for treatment.... Last year the city collected nearly $1.5 million.... With the new mobile laboratory...the revenue should increase by as much as $500,000 this year...."

Problem: Design a method for fining companies, towns, counties, and states that pollute the nation's waterways.

Item: Chemical and Engineering News, March 9, 1970, "Pollution Problems Get Assist from NAA of Air." "Technique determines composition of 33 elements in solid particles from air.... Neutron activation analysis (NAA) of particles carried by air will give investigators of air pollution an effective tool for understanding mechanisms of solids transport and discovering sources of pollution.... Applicability to arsenic, antimony, mercury, and selenium gives information vital to

judging health dangers of air polluted by sizable amounts of these elements...."

Problem: Is neutron activation analysis able to analyze all major pollutants, or are other methods to be sought? It is clear that NAA will not work for gaseous pollutants; what is to be done to assess their discharge into the atmosphere?

Item: Wall Street Journal, March 26, 1970, "Conservatives Press Suits." "In Phoenix, two university professors and their wives are seeking $2 billion damages from six copper companies that operate copper smelters in Arizona. The suit charges that smoke from the smelters is injurious to health, restricts visibility, and damages the environment. The plaintiffs are asking that damages be divided among 700,000 inhabitants of...Phoenix...."

Item: Wall Street Journal, March 26, 1970, "Juarez Citizens in Suit Against US Firm." "$1 billion in punitive damages caused by a smelter.... Fumes are causing dermatitis, tuberculosis, cancer and atrophy of male sex organs...."

Item: Civil Engineering. April 1970, pg. 81, "President Proposes 'User's Fee' on Industrial Effluents." "In February, President Nixon proposed establishment of an environmental financing authority to insure that when a city issues bonds to finance pollution-control construction, these bonds are sold. He proposes charging a user's fee to each industrial company discharging effluent. Municipalities receiving Federal assistance in construction plants will be required to impose reasonable user's fees to meet the cost of treating industrial wastes. In the realm of solid wastes, the President calls for a bounty payment or other system to promote prompt scrapping of junk automobiles; its price should include the cost of producing it and the cost of disposing of it...."

PROBLEM OF PHOSPHORUS IN WASTE WATERS

Item: Chemical and Engineering News, March 9, 1970, "Eutrophication: Restoring the Lakes." "Phosphorus is the major contributor to eutropnication of lakes (overfertilizing caused by nutrient abundance) because it stimulates algal growth.... Unlike nitrogen, which also contributes to eutrophication, phosphorus doesn't enter into biochemical reactions that permit it to escape from water as a gas, nor is it easily removed from water by organisms or sediments...."

Item: N. Y. Times, March 8, 1970, "L. I. Shellfish Beds Reopen as Duck Farms Curb Waste." "Long Island's duck farms have made enough progress in cleaning up pollution for the State Conservation Department to reopen about half the shell fishing beds.... All the duck farmers had complied with the department's order to build sewage-treatment plants.... The sewage processing does not eliminate phosphates from water.... The general manager of the Long Island Duck Farmer's Cooperative said the cooperative would support a $30,000 research project to find out how to eliminate phosphates from waste...."

Problem: Find new methods to remove phosphates and nitrates from water. In Israel, the Far East, Africa and some other highly populated areas, ponds are deliberately enriched with phosphates and nitrates, manure, and offal, to make fish grow fast. Fast breeding and fast growing species, algae eaters sufficiently hungry to keep up with algal blooms, are important foods. Israel even has a birth control project for algal-eating fish so that they will grow larger, their population being controlled chemically. The preferred solution to phosphate pollution of water would be a biologic one, a winter resistant, fast breeding, algal-eating animal, fish, crayfish, insect with water-living larva, etc. Find such solutions.

Item: Air and Water News, Vol. 4, No. 2, February 16, 1970, "Canada Launches Anti-Phosphate Push." "Canada's Minister of Energy, Mines, and Resources, J. J. Greene, is attempting to persuade the ten provincial governments to ban or limit the use of phosphates in detergents...." February 23, 1970, Vol. 4, No. 1, "Canada to Ban Detergent Phosphates." "[A]greement on total ban by 1972...."

Problem: What are the relative contributions of fertilizers and detergents to phosphates in run-off waters? If detergents are minor compared with phosphate contributions of fertilizers, is there point to banning phosphates from detergents just now? Should the effort rather be to find ways to use phosphates in lakes and streams in economically beneficial ways?

Item: Wall Street Journal, March 26, 1970, "P and G is Cleaning Up Its Detergent Formula," "P and G is phasing out phosphates in laundry detergent...turning to sodium nitrilotriacetate, called NTA.... By May, NTA will replace 25% of phosphate in one-third of its laundry detergent.... P and G believes NTA doesn't have any adverse effect...."

Problem: Will replacements for phosphates in detergents have unforeseen adverse effects?

Item: Science, Vol. 3, No. 9, May 3, 1968, "Catfish Farmers Reap Year-Around Crops." "Farmers in the South have a new cash crop--Catfish--producing more than 15 million pounds of fish annually and a gross income of $5-6 million. Within a few years the annual production is expected to increase to 40 million pounds. In Mississippi about 6000 acres of farm ponds are planted to catfish. About 4000 acres of ponds are being farmed for catfish in Arkansas...." The fish in these commercial ponds are fed with regular field fertilizers which support algae for fish food.

Item: N. Y. Times, May 28, 1970, pg. 24, "Phosphates are Replaced in Some Detergents." "NTA, or nitrilo-triacetate, is being used to replace 25% of phosphate in one-third of the packaged detergent output. Until recently, NTA has been considered too problematical in its environmental effects to be adopted as a substitute for phosphates. Senator Muskie, Chairman of a Senate Subcommittee of the Senate Public Works Committee, asked 'If after 12 years of study, you can't tell us the consequences of phosphates, what are the chances we can get answers on other euthrophicants?'...."

USE OF SHORELINE LAND FOR NUCLEAR POWER REACTORS, OR NOT

Item: Nucleonics Week, March 5, 1970, "70 Sites for Nuclear Power Stations in the South...will have to be found by 1990.... Heat dissipation from an adjacent water surface is assumed. Where this water surface does not exist or cannot be built, or where temperature rise through condensers is limited for ecological reasons, cooling towers may be applied.... 38 of the future sites could be located on lakes, including TVA lakes; 9 of the sites would be on Delaware Bay, Pamlico Sound, and Mobile Bay; 10 sites were suggested for the Mississippi and one for Savannah River; and 12 sites on the Atlantic Ocean and Gulf of Mexico...."

Problem: Rapid acquisition of sites for booming nuclear power plant industry depletes vanishing shoreline lands and removes them from recreational and wild-life use. Is it reasonable to restrict future power plants to inland sites, requiring them to build cooling towers and/or artificial lakes for their cooling requirements?

Item: Nucleonics Week, March 12, 1970, "Water-Use Rights on the Rhine for Nuclear Power Plant Cooling...has the makings of a good sized squabble between West Germany and Switzerland.... Germany hears that the Swiss are claiming 80% of the river's cooling capacity and fears that the Swiss are trying...quick action on nuclear plants.... The Swiss would not be willing to settle for less than 65-70%.... At least 80% of water forming the upper Rhine originates in Switzerland. Five German power plants have been proposed for the upper Rhine.... Predictions are that eventually there will be nuclear plants at approximately 12-mile intervals along the Rhine...."

Problem: Rapid acquisition of sites along rivers will lead to squabbles between states over apportionment of cooling capacity of rivers passing through them and lakes on which they border. Is the solution of such predictable impasse situations to forestall them by requiring future power plants to build their own cooling facilities independent of existing natural waters.

Item: Nucleonics Week, March 5, 1970, "Duke Power will put the new units at Lake Norman, an artificial [lake] whose construction was completed in 1963."

Item: Nucleonics Week, January 22, 1970, "Unhappy at the thought of sharing their coastal beauty with a nuclear fuel reprocessing plant, the people of Sannaes--a picturesque tourist area of western Sweden--last week held a day long information meeting.... At issue is land purchased by AB Atom-energie...."

Problem: Design inexpensive methods of building cooling ponds, small artificial lakes for power plants, perhaps plastic lined or lined with ground-up glass and ground-up newspaper. Design cooling ponds in such a way that fish aquaculture can be operated symbiotically in the coolest of them.

Item: Oceanology International, February 1970, p. 17, "Salmon Aquaculture Project Succeeds." "University of Rhode Island's Marine Experiment Station reports success in experiments to raise fish in outdoor plastic lined pools. Dr. Saul Saila...thinks fish can be produced more cheaply through aquaculture than by commercial fishing...."

Item: Los Angeles Times, May 11, 1970, "Limit Removed on Salton Sea Sargo--Estimated in Millions." "In 1951, biologists Phil Douglas and Willis Evans caught 65 sargo on hook and line at San Felipe in the Gulf of California and transplanted them in the Salton Sea. Today the sargo (otherwise known as croaker and blue perch) number in the millions, reach a weight of almost 3 pounds, are an excellent table fish, and can be caught more readily than corvina. Sargo frequent jetties, piers, barges, barnacle encrusted rocks, submerged brush, and tree lines...." The Salton Sea is a warm water sea.

CONSTRUCTIVE USE OF SEWAGE

Item: Air and Water News, February 23, 1970, p. 5, "Soviets Make Animal Feed from Sludge." "Activated sludge from waste treatment plants can be used directly as high-priced animal feed instead of being buried, burned or employed as fertilizer as is now common, according to research by Soviet scientists. Scientists from the USSR's All Union Research Institute of Vegetable Materials Hydrolysis found that the dry microbe mass of the removed sludge normally accounts for 40% by weight...the protein content averages 38-40% and includes 15 amino acids and vitamins of the B group, including B-12.... At a normal plant, production can amount to 10 metric tons a day. In a fodder yeast plant...output of activated sludge reaches 9000 tons a year.... Leningrad Agricultural Institute found that 1% addition of sludge to feed provides all necessary B-12.... All Union Poultry Farming Research Institute says a 1% addition raises live weight of birds by 4% and protects young fowl...."

In the undisturbed wild world, sewage provides food for plants and animals which in turn provide food for the polluters. Biological solutions to pollution must therefore be available to every sewage problem. Is the Soviet method economically viable? Are there other similar ways to feed sewage in high concentration to a life form which provides nutrient to economically useful plant/animal populations?

BIOLOGIC EFFECTS OF ATMOSPHERIC LEAD

Item: Chemical and Engineering News, March 9, 1970, "Lead Concentration in City Air Increases." "The facts about leaded gasoline and its impact on air and public health have been little known and are often contradictory.... During the temperature inversion, lead content of downtown San Diego air approaches 8 micrograms per cubic meter of air, nearly that of the national air quality limit.... Lead aerosols constitute as much as 7% of total suspended particulate material in air.... Coarse fractions settle out along roadsides and account for high lead concentrations in soil and vegetation.... Fine lead aerosols are able to travel long distances and are often washed out of the atmosphere in rain and polar snow...."

Problem: Study the cycling of lead through the atmosphere into the biosphere. Determine its effects, if any, on living plants and animals. Lead pipes have been used for water conduits and household plumbing since antiquity, and still are in service in fine old houses of New York, Philadelphia, Chicago, Boston, etc. Is there evidence for detrimental effects on health of occupants of these houses, records for whom will be available for the last three centuries? Compare and correlate with what is known of lead poisoning as reported in industrial medicine, e.g. paint industry, mining, etc.

CLEAN-UP OF SPILLED FUEL OIL: A FEDERAL CLEAN-UP SERVICE

Item: N. Y. Times, March 24, 1970, "Fuel Tank Leaks Oil in East River." "Slick extends from Bronx to Staten Island. A leaking oil storage tank at 149th Street and the East River has left a coating of oil along the East River, across New York Bay and as far as the Staten Island shore.... A water pollution investigator said...it will be years before the traces of oil are gone. Even when the surface oil has been washed out there will still be oil coming off the rocks and shoreline...."

Item: N. Y. Times, March 24, 1970, "Muskie Asks Hickel if Legal Measures Will Be Taken Over Oil Leak in Gulf." "One of [Chevron's] 22 drilling platforms caught fire.... Since the fire was extinguished, one well has been spewing 600 to 1000 barrels of oil a day into the Gulf, threatening oyster beds, shrimp fishing grounds and wild life.... Inspection by the Geological Survey of Chevron's 295 penetrations into its 12 wells has disclosed 147 violations of Federal regulations...."

Problem: Find ways to combat and clean up leaked oil in harbors, rivers, lakes, beaches, and the open ocean. Until now the "best" way is said to be with straw, which must be removed after it has soaked up oil. Can pumice, vermiculite, expanded lava, ground-up newsprint, or even sand be sprinkled on, with the result that the clotted mixture of oil and clean-up material sinks, or can be dredged together on the surface? Plan a Federal oil clean-up service.

Item: The Economist, May 2, 1970, p. 73, "Slick Work." "Shell has recently developed a machine for spraying sand onto oil slicks, which then sink to the bottom of the sea. Off the Hook of Holland, 95 out of a 100-ton slick of Kuwait crude was cleared in less than 45 minutes. The trailing hopper suction dredger used can carry enough sand to sink 2500 tons of oil. The method is said to be harmless to marine life...."

Item: Industrial Research, May 1970, p. 27, "Oceanic oil spills soon might be cleaned up by spraying urethane foam chips onto the water's surface. The technique not only recovers oil in protected

waters but will do so in open seas with severe wave action. The foam chips absorb oil but not water, and are recollected on a conveyer belt that lifts the chips to a compression unit. Here the oil is squeezed from the chips, which are then reusable...."

Item: Industrial Research, March 1970, p. 67, "Small cellular glass beads can be used to burn off oil spills completely. Unlike other techniques of burning, no residue is left. Acting like a candle's wick, the tiny glass nodules continue by capillary action to pick up oil as the thin film covering them is burned away and can be used again on other oil spills or left in the water...."

Problem: Design a costing system so that anyone responsible for an oil spill is charged for the automatic services of the Federal oil clean-up service.

CONSTRUCTIVE USE OF JUNK

Item: Technology Review, February 1970, "Concrete From Glass: A proposal for using city trash collections as building material.... Up to 75% of incinerated refuse is glass and metal.... Nearly 15 million tons of the nation's annual trashpile may be composed of waste glass.... The plan is to recover glass powder for use as aggregate to replace sand in aerated concrete. [Aerated concrete is a "foamed" cemented mixture which can be formed into panels and short beams; it can be sawed and fastened, has good thermal insulating and fireproof qualities and is ideal for prefabricated construction...] Pulverized fuel ash is already used in the U.S. as concrete aggregate, and incinerator ash is used in Europe for road building...."

Problem: What uses can be made of discarded bottles, junked cars, scrap iron? If they can be reduced to small particles at small cost, can they be used economically for house building, road building?

Item: N. Y. Times, March 13, 1970, "Sea Lab Seeks Uses for Old Cars and Other Junk." "Cars have become building blocks of artificial reefs laid in the Atlantic off Long Island and at six other sites down the coast as far as Florida, to provide anchorage [for] marine plants and animals and refuge for crustaceans and small fish...using waste constructively.... Bottom samples showed cigarette butts virtually undamaged in the sludge ooze.... A reef...laid down in 50 feet of water consists of 400 car bodies, 500 tons of culvert concrete, 30,000 old tires, and six sunken barges...tires...are tied together in stacks of six or seven by iron rods...barnacles, hydroid growths and algae immediately begin to accumulate on the stack...these life forms seem to like a rubber base...."

The enormous growth of commercial and recreational marinas along both coasts may offer a use for tires and junk cars to build breakwaters. Study of the coastal waters on both continental shelves should be made siting artificial junk reefs for optimal fish nurturing and recreational use, keeping in mind effects of changing the present coastal currents.

Can commercial fisheries be based on junk reefs? Can reefs like Hatteras and Fire Island be built along both coasts?

Item: Civil Engineering, March 1970, p. 25, "Riverview, Michigan, is looking for more refuse than it generates. The city has a long term project to create a recreational complex built on hills of refuse. The sports complex will have a 200-ft high ski hill with five runs as well as a sledding and toboggan hill. The mountain will be compacted and buried refuse. Around it will be an 18-hole golf course, stables, walking and riding trails. Excavation for the landfill cover will form a lake. The complex will be on a 600 acre site, with landfill occupying 80 acres, will require 7 million cubic yard of compacted earth and refuse...."

Item: Ibid, "American waste is growing at a rapid rate. Today it is 5.3 lbs per person per day, and by 1980 will be 8 lbs per day...."

Item: Wall Street Journal, May 28, 1970, p. 6, "Firestone to Test Making Used Tires Into Chemicals." "If the pilot plant proves successful, Firestone will set up 10 plants capable of consuming 100 million worn-out tires per year. Shredded tires will be heated to break them down into various chemicals. Solid residue can be used as a filtering medium in sewage treatment, as a particulate in concrete, and as a smokeless fuel. Some chemicals can be recovered, and liquid and gaseous products can be used as fuel...."

WEATHER MODIFICATION FROM DUST; STUDY OF EARTH ALBEDO

Item: Technology Review, April 1969, "The burning of fossil fuel now releases 15 billion tons of CO_2 into the atmosphere annually.... The familiar greenhouse theory suggests that this would cause climate to become warmer...but atmospheric turbidity offsets this effect, and the result is a rapid downward trend of temperature.... Large sections of the world are characterized by high levels of dust and smoke.... Little attention has been paid to the climatic effect of millions of square miles of dust cloud cover.... Some dust concentrations seem to correlate with agricultural activities, others with rapid industrial development.... Since the industrial revolution is still underway, there is little that any one nation can do to reverse the trend.... Studies of dustfall on snowfields indicate a catastrophic rise of 19-fold.... The regional effect is to reflect heat from the sun back into space.... Increased turbidity will weaken the prevailing westerlies and...have profound effect...."

Problem: Collect in systematic way all data revealing change in earth's albedo; for example, photographs from Apollo and Gemini satellites may allow evaluation of albedo in equatorial and southern hemisphere. Correlate to world economic factors such as GNP, agriculture, power, population growth. Extrapolate and predict future average temperatures, climates, winds, etc.

Item: Technology Review, July/August 1968, p. 41,"Radiometric observations in the visible spectrum by both TIROS and Nimbus have shown the average albedo of earth and atmosphere about 5% above pre-satellite calculations.... Net amount of heat lost to space must be higher than previously assumed."

Item: Technology Review, April 1970, p. 73, "Africa to Carribean." "J. M. Prospero of the Institute of Marine and Atmospheric Sciences at the University of Miami, and associates, have been sampling the trade winds of Barbadoes. The dust load in this air, he told the American Chemical Society, is average for a suburban area--5-6 microgram/cubic meter of air--but sometimes as much as 26. Except for

abnormal quantities of lead, zinc, and tin there is little evidence of pollution. These minerals are believed to result from circulation which brings air from the U.S. industrial northeast into the Azores, from whence it returns to the Caribbean. The size of dust particles in Barbadoes air correlates with weather conditions over the Atlantic, the quantity with dust storms over Africa. Six days after a severe African dust storm, 1 million tons of dust descended upon the Caribbean...."

Problem: Collect data to allow estimates of residence time of particulates in air.

Item: Science News, April 18, 1970, p. 390, "A study of precipitation by days of the week during the last half century at 22 weather bureau stations in cities of the eastern U.S. reveals a clear distinction between weekdays and weekends. More rain falls on Tuesdays through Fridays than on Saturdays and Sundays. Mondays appear to be an in-between transition day. The implication is that particulates from workday human activity serve as nuclei to increase rainfall. A group from Washington State has reported that areas downwind from pulp and paper mills have shown marked increases in rainfall (perhaps) considerably greater than those in deliberate cloud seeding projects to produce rain...."

HURRICANE CONTROL AND PREDICTION

Item: N. Y. Times, February 25, 1970, "Study of daily photographs from satellites (Nimbus, Tyros, etc.) allows history, birth, growth and decay of hurricanes to be studied, and dust and pollution to be monitored, from 100 miles altitude. Is African dust a factor in hurricane production?" Item: Science, Vol. 167, No. 975, 1970, "Is Radon from Africa transported in north Atlantic tradewinds a factor in releasing rain and hence heat to drive hurricanes?" by J. M. Prospero and T. N. Carlson.

Item: Technology Review, July/August 1968, p. 42, "Satellite observations [show] that tropical cyclones occur with far greater frequency in the eastern Pacific, off Baja California, than had been suspected. Atlantic hurricanes have been shown [to form] from disturbances that move westward from at least as far east as the coast of Africa.... The reasons why only a few become severe are still far from known.... But satellites have brought us closer to the day when we can predict a hurricane...."

Problem: Correlate weather data from TIROS and Nimbus with dust data from satellites.

MONITORING OCEAN POLLUTION

Item: Technology Review, April 1969, "Changes man makes in atmosphere may appear quickly, but [changes] in ocean can take millenia to reverse.... Some 3000 tons of mercury reach oceans each year from natural continental sources and 4000 tons from fungicides and industrial processes; lead input from automobile fuel is roughly equivalent to that from sedimentary...carbon containing substances generated by man are at least as important as those generated by photosynthesis in ocean-growing plants; pesticides are widespread and so are radioactive species; two new elements, sewage outfalls and accidental pollutions, of which one of the largest has been petroleum from the Torrey Canyon.... Perhaps half of these contaminants are introduced into ocean by the US.... The general effect is little known...."

Problem: Estimate increasing yearly contaminations of ocean and understand consequences of chemical perturbations, extrapolate effects to future years, assess consequences, recommend how to forestall critical problems before they arise.

Item: N. Y. Times, May 10, 1970, "Biologists Develop Pollution Warning." "Two biologists of the Naval Oceanographic Institute studying biological fouling organisms (marine plants and animals, barnacles, etc.) have found ways to use them as warning signs of encroaching water pollution. Local species of marine befoulers serve as indicators of amount of pollution in populated marine areas particularly near naval bases...."

Problem: If barnacles and other types of organisms can live attached to surfaces in polluted waters, might they be implanted to help clean the pollutive materials from the water.

Problem: Design a monitoring system for degree of pollution using befouling organisms as indicators of degree of pollution.

REUSE OF GOLF COURSES AND GRAVEYARDS IN CITIES

Golf courses are restricted from public use, occupy large areas of land in thickly populated cities, and pay disproportionately low taxes because of their "unimproved" status. They are anachronistic in that cities have grown up around them, and have surrounded empty land by land populated with thousands of people per square mile. Examples are the lovely green fairways imbedded in the heart of Los Angeles.

The same may be said of graveyards, a particularly conspicuous example being the enormous graveyard along the Queens Tunnel Thruway a few miles east of the East River, in Queens, New York.

Problem: Design plans for best use of these restricted lands, for public use in large heavily populated cities.

REUSE OF RAILROAD PROPERTIES AND RIGHT-OF-WAY

Item: Wall Street Journal, March 26, 1970, "The Trains Don't Stop Now, but Old Depots Are Very Much Alive; Railroads Eager to Sell Them." "Railroads desperate for revenue are more than happy to sell or rent premises. The big old depot in Chatham, Massachusetts has been converted into a railroad museum.... The Maryland Institute in Baltimore...college of art occupies Baltimore's old neo-Renaissance depot built in 1896 and bought from B and O for $250,000 (with 3 acres of land) in 1964.... The building now houses a lecture room, an art gallery, library, studios and sculpture school.... Abilene, Kansas...now is obtaining a railroad station to become the Historical Theatre of Kansas.... Teenagers of Berkeley Heights, New Jersey, may get to use the local station free...for a coffee house.... It's suitably dark and dingy so it meets the requirements of a discoteque.... In Dover, Delaware, the old depot is the town library...."

Railroad stations have strategic locations in the more dense centers of towns, today are little or not-at-all used, offer great potential for reuse for public meeting halls and to fill various public needs such as for libraries, pool-rooms, bowling alleys, gymnasiums, lecture and concert halls, community theaters, etc.

Problem: Survey unused railroad round-houses, stations, freight-yards, right-of-ways, barns, switch-yards, repair shops, water towers, sidings, used and unused freight and passenger cars, and find new community uses for hard-pressed heavily populated cities and suburban areas.

POLLUTION AT FEDERAL AND CIVILIAN MARINE FACILITIES

Item: Science, February 20, 1970, p. 1104, "Pollution at Federal Facilities." "Declaring that the federal government has become one of the nation's worst polluters, President Nixon has issued an Executive Order requiring federal facilities to conform with air and water quality standards established under federal law. The order establishes a $359 million dollar program, prohibits transfer of funds to other programs...."

Problem: Design shipboard sewage treatment facilities, and/or sewage containment facilities for aircraft carriers, cruisers, submarines, PT boats, Coast Guard cutters, ice-breakers, dredges, etc., including the Presidential yacht.

Item: N. Y. Times, March 22, 1970, "Pollution: In spite of everything." "The law prohibiting boatowners from discharging waste matter into the water of New York State has become a reality.... Three holding tanks (and) four recirculating toilets [were] approved.... Boatmen are learning that cost is nothing compared to finding one that fits, learning how it operates or does not if a boat is heeling, how long before it fills up and what to do when pumping out is necessary.... Questions seem to defy answers: How does the law pertain to out-of-state boatmen? How does a N. Y. skipper follow the law when cruising out-of-state with a legally sealed holding tank? How can the law be enforced? What about boats arriving from international waters exempted from state law under the Federal Quarantine Act? What about a boat that needs one custom fitted that might not be approved afterward? What will you do when a recirculating toilet refuses to operate when angle of heel is more than 9 degrees? What does a racing class sailor do about this added weight?...."

Problem: Invent a sewage system for boats.

REVITALIZATION OF CITY SLUMS

Item: N. Y. Times, March 21, 1970, "Genoa: City in the Habit of Dying." "This city tends to think it is dying and...it won't be the first time.... Genteel decay hangs over the crowded narrow streets...bustle in the port.... Every inch of dock space is occupied and a dozen cargo ships ride at anchor awaiting unloading space.... High costs, as much as 20% above other Italian ports due to an aggressive longshoreman's union...."

Problem: Is the cure for slums, urban renewal and replacement with new housing, any more than a palliative? How have cities treated the age-old problem of slums and central decay; have any methods been successful? This problem is that of the history of slums. Some cities, such as Rome, have cleared slums by building wide thoroughfares through them. Is this method successful?

Item: N. Y. Times, May 22, p. 1, 1970, "Urbanists Pinched for Money." "In St. Louis, a patrolman says of a row of houses, 'Even the rats abandoned.' Abandonment, evident in St. Louis is increasing in older cities across the country. In New York, Philadelphia, Detroit and elsewhere whole neighborhoods are being evacuated. A Federal official says, 'There are parts so empty they look like someone dropped nerve gas; its not urban blight, its urban leprosy.' One observer remarked that in a throwaway society we are now throwing away cities...."

Problem: Is it a reasonable plan to build cities for 10 or 20 year occupancy only and to systematically burn them down and plant trees, moving their people to a new city, built on the edges of the city remaining unburnt? Shall we find the least expensive method of running cities is to throw them away systematically?

DESIGN A NATIONWIDE PASSENGER TRAIN SERVICE

Item: N. Y. Times, March 11, 1970, "Of Nation's Storied Passenger Trains Little is Left But Names and Memories." "What remains of rail passenger service in the U.S. is the skin and bones of a national network.... The overall pattern is clear. Railroad service is in the final stages of collapse.... The intentions of Congress are often in conflict.... A proposal by the Senate Commerce Committee offers a range of ideas.... The heart of the bill is the creation of a national rail passenger system as the basic intercity network.... No one has specified which trains would be part of the network.... The Department of Transportation is reported to favor corridor projects of the Metroliner scope.... The Senate bill includes two forms of subsidy: First, in capital grants, about $200-million over the next four years to buy and lease new equipment; second, the first railroad operating subsidy up to $60-million a year.... That level of subsidy would sustain barely a third of the passenger service that is still operating today.... The Railpax plan would establish a quasi-public corporation to run passenger trains on the new national network for profit, without subsidy, and trains that lost money would be pruned without consideration of public need...."

Problem: Review the nation's needs for rail passenger service and design a workable plan, using the skin and bones, still existing. Railways in the U.S. are the only ones in the world not nationalized. Survey successful railway systems and recommend legal structure to revitalize those in the U.S.

Item: Wall Street Journal, May 7, 1970, "Senate Approves Railroads' Plan for Passengers." "The bill passed 78 to 3, would establish a quasi-public, for-profit corporation to operate passenger trains on intercity routes. There are an estimated 450 passenger trains still operating, compared to 20,000 in 1929, and railroads want to discontinue more. The proposed Corporation would take unprofitable trains off the railroads' books, and would run trains itself or contract for others to do so. A railroad that declined to turn its passenger trains over would be forbidden to discontinue service until 1975...."

USE OF SEWAGE AND WARM WATER EFFLUENT FROM POWER PLANTS TO GROW FISH

Item: N. Y. Times, March 26, 1970, "Burgundians Observe a Fading Fish-Harvesting Rite." "A good many owners take in a crop of carp, pike, tench and perch every two years. Mr. Untel cranked the sluice gate open, seized squirming fish and heaved them into boxes...."

Problem: Can the problem of sewage disposal and thermal pollution from power plants be solved for each community by a symbiotic combination of fish-culture ponds containing warm water around from the power plants, growing algae at a rate sufficient to feed an enormous population of fish, the algae being fed from sewage? Design a symbiotic system optimizing each part of the cycle for complete sewage disposal; this problem seeming to be the most difficult.

RESOURCES OF CONTINENTAL SHELVES OF WORLD FOR THE UN?

Item: Wall Street Journal, March 27, 1970, "Sharing the Wealth; Nixon is Urged to Yield Ocean Floor Oil to Help World's Poor." "Counselors are urging Nixon to renounce American rights to off-shore oil under the Atlantic, Pacific and Gulf of Mexico and deed it to the United Nations.... The oil these men want the President to relinquish lies beyond a line averaging 25-30 miles off-shore.... Other coastal countries would be expected to renounce their own mineral rights to proportionate blocks of ocean bottom...."

Item: N. Y. Times, March 26, 1970, "Brazil Extends Limits 200 Miles Out to Sea." "President Medici issued a decree extending Brazil's territorial waters to 200 miles.... The decree was viewed as evidence of Brazil's growing interest in off-shore oil, as well as to protect fishing industry...."

Problem: Study optimal use of natural resources of continental shelves for national and international welfare.

Item: N. Y. Times, May 24, 1970, p. 28, "Nixon Proposes a Treaty to Exploit Seabed for All." "The President urged all nations to renounce territorial demands to the seabed beyond a depth of 660 feet and called for a treaty to establish an international regime for the exploitation of seabed resources beyond this limit. The U.S. will introduce specific proposals at the next meeting of the UN seabed committee...."

COSTING STUDY FOR FEDERAL OIL-CLEAN-UP SERVICE

Item: N. Y. Times, April 4, 1970, p. 30, "Curb on Oil Spills is Signed by Nixon; New Law Raises Penalties and Expands Liability." "The new law covers spills from onshore and offshore installations as well as from vessels....The conference committee that drafted the final version was deadlocked for weeks on the question of liability for the cost of cleanup.... If the U.S. cleaned up the spill, the owners were liable for reimbursement of costs up to a limit.... $5-million or $67 a gross ton of the vessel, whichever was less. But the government has to prove gross negligence.... The new act introduces absolute liability without regard to whether such act was negligent.... The owner of the vessel is liable up to $14-million or $100 a gross ton, whichever is less. Owners of onshore and offshore facilities are liable for clean-up costs up to $8 million.... The new law authorizes a $35-million revolving fund to finance government clean-up activities."

Problem: Will the revolving fund run dry owing to inadequate costing as presently assessed? How are indemnities to be paid for spoilage of shell fishing grounds, free swimming fishing grounds, sea weed beds, recreational facilities, such as marinas, beaches, reefs, spoilage of nets, lobster pots, etc.?

Item: N. Y. Times, May 10, 1970, "Indictment for Spiller of Oil." "Last week a Federal grand jury in New Orleans animated the law (Outer Continental Shelf Act, 1953) for a 900-count indictment that could cost the Chevron-Oil Company up to $1.8 million in fines...."

RECLAMATION OF DERELICT LANDS, STRIP MINE DEBRIS, ETC.

Item: New Scientist, March 12, 1970, p. 508, "Poultry Droppings Feed Cows and Reclaim Tips." "An attractive proposition is to use droppings (from intensive poultry-raising factories) to reclaim the tips and derelict lands around coal fields. Researchers at the National Agriculture Advisory Service, Llanishen, Cardiff, began mixing Italian rye grass with hen slurry and applying it to tip material. When broiler litter was tested in the same way...at a rate of three tons per acre, germination was good, especially compressed materials formed a sort of sandwich. Sheep can now be seen grazing there and further trials are underway.... The technique looks hopeful...broiler litter contains all essentials for plant growth--nitrogen, phosphate, potash, micro-organisms, calcium, manganese, cobalt and magnesium...."

Problem: Consider and recommend ways to reclaim derelict lands, mine tailings, stripped forest-lands, strip mines, deserts that once were forests, etc.

Item: N. Y. Times, May 10, 1970. "Critics of Strip Mine are Stepping Up Resistance." "A lawsuit for $2.1 million damages for 'wanton reckless disregard' of property owners' land, water, and esthetic rights has been filed against the Bethlehem Steel Corporation in Millstone Creek. Bethlehem plans to start stripping on 50,000 acres it owns in Tennessee. Two weeks ago the five man governing body of Knott County, Kentucky adopted a resolution declaring strip mining to be a public nuisance and against public policy. In Raleigh County, West Virginia 600 citizens have signed a petition demanding that the county outlaw further strip mining to prevent pollution of Big Coal River. In Missouri the 200-square mile strip mine left by the Peabody Coal Company in Randolph and Macon Counties has spurred the Ground Reclamation Organization of Missouri to demand a state strip reclamation law. Senator Gaylord Nelson's Federal Mine Lands Restoration Act would impose Federal

strip mine control and restoration standards upon states that did not enact their own. Acid mine pollution has already found its way into 7,000 miles of Appalachian streams, and the flow is growing. In West Virginia last year, strip mine production rose 13%...."

Item: N. Y. Times, May 24, 1970, p. 20, "Pacific Isle Seeks to Replenish Soil." "Leaders of the island state of Nauru are facing up to the staggering environmental problem of rehabilitating the growing desert created by open-cut phosphate mining. 'If we could reclaim only 10% of the worked-out land, it would double the present 500 acre area of arable land,' said the director of the Soil Conservation Service of the U.S. Department of Agriculture. He has suggested combining imported topsoil with cultivation of soil-creating plants such as soybeans...."

COSTING STUDY FOR TRANSMISSION OF ELECTRICAL POWER

Item: Wall Street Journal, April 6, 1970, p. 20, "Shortage of Low-Sulphur Coal Hampers Electric Utilities in Anti-Pollution Efforts." "Another possibility is shipping the electricity instead of coal. Utilities would build steam plants at the Western mines, and then use extra-high-voltage transmission cables to send electricity to users. Use of this technique is considered imminent both out West and in the more remote sections of the Eastern coal fields. Presently, the cost of extra-high-voltage transmission is quite high...."

Problem: Make costing studies of power transmission by various cryogenic techniques, and make optimum siting of power plants for optimal length of cryogenic transmission lines in the USA.

EFFECTS OF HOT PIPELINE IN ARCTIC

Item: N. Y. Times, April 6, 1970, "Arctic Pipeline Test Promises Wide Boon." "An experiment that could bear on the cost of home heat, industrial fuel, and gasoline for millions of Americans is being conducted at the top of the North American continent...a study of the feasibility of moving oil and natural gas from the Arctic coast up the Mackenzie River Valley, 1300 miles to Edmonton, Alberta, and then to markets principally in the Midwest.... About 2000 feet of 48-inch pipeline has been laid in a loop and hot crude oil is being pumped through it day and night...to determine how much a hot pipeline would melt the permanently frozen ground and what consequences thawing of the permafrost might have.... What the experiment fails to examine is whether a pipeline running along the coast and up the Mackenzie Valley would disrupt the migratory and reproduction habits of wildlife, especially caribou. It is uncertain that they would go under a pipeline raised above ground. If it lay on the surface covered with gravel, caribou (might not) go over it unless driven. In spring, after calving, a herd of 130,000 caribou grazes along the roots for the pipeline from Proudoe Bay to the Mackenzie Delta. One solution might be to bury the pipeline under the many creeks and rivers that run northward to the sea and are natural avenues for the caribou. Because animals tend to congregate along the pipeline looking for crossings it might be necessary to prohibit hunting within some distance of the pipeline...."

Problem: Study environmental and economic effects of the hot pipeline in its extent over 1300 miles. Study effects of oil and gasoline delivery on heating and fuel industry.

Item: N. Y. Times, May 6, 1970, "Naval Research Official Warns on Alaska Pipelines." "The head of the Naval Arctic Research Laboratory, Max C. Brewer, was critical of plans for burying in the permafrost all but about 50 miles of pipe, which would carry oil at 155 to 180 degrees, particularly critical of plans to construct only

about 7 miles above ground. The Soviet Union elevates natural gas lines in wilderness areas to 15 to 20 feet. Mr. Brewer noted that potential earth settlement was much greater than the allowance sag, risking breaks and large oil spills...."

Item: Science News, April 18, 1970, p. 380, "TAPS plans to include an elaborate earthquake monitoring system that would close valves the minute that there was a seismic disturbance...."

Item: Nature, Vol. 226, No. 207, 1970, "Nobody knows what effect a strip of soggy ground 30 feet or more in width would have on the migration of caribou, but lesser changes in the environment, building roads, for example, have in the past markedly changed their ways...."

Item: N. Y. Times, May 24, 1970, p. 16, "Polar Bear Denning Area Identified." "The most important polar-bear denning area in the world lies on the southwestern shores of Hudson Bay, about 100 miles south of Churchill. The area is earmarked by oil companies for exploration, that, if not properly regulated, could upset polar-bear reproduction. About 60 bears are believed to have reared young there this year...."

STRIP MINING ON OCEAN BOTTOM

Item: N. Y. Times, April 6, 1970, "Disputed Underseas Mine Once a Project of Museum." "A mining company has begun to strip away the sea bottom in the Bahamas to extract aragonite in a sea bottom area of more than 5.2 million acres, an area nearly twice the size of Connecticut. The rights to the mining were originally granted by the Bahamian Government to the American Museum of Natural History. Although the museum is a leader in conservation, its director knew of no studies to determine if damage might be done by the mining operations. He said, 'We had something marketable and we went ahead and sold it. Maybe some fish might be disturbed but they could probably find somewhere else....' Bulk transport craft carry away a single load up to 80,000 tons of aragonite.... Already the company (Ocean Industries merged with Dillingham Corporation) has built its own island with dredgings. It is expected to grow to 200 acres by the end of the year...to build 11 additional islands that could change the face of the area...a giant terminal for super-tankers too large for ports on the American mainland...." "Dr. Grant Gross, research oceanographer, characterizes the operation as a marine strip mine that could leave lasting scars. By 1980 more than 5-million acres will have been defaced in the US by strip mining...."

Problem: What are the large range temporal and long range geographical consequences to ocean ecology, ocean currents, ocean climate, shrimp fishing, commercial free swimming fish industry, recreational use of the waters, absorption of sunlight caused by turbidity where none existed before, etc.? Will there be effects such as enhanced algae blooms and growth of micro-organisms induced by stirring up ocean floor which will be beneficial by providing fish food?

Item: Wall Street Journal, May 8, 1970, p. 2, "Alcoa to Build Dock At Chesapeake, Virginia for Jamaica Alumina." "Aluminum Corporation of America will build dock and storage facilities at Chesapeake, Virginia to unload and store alumina from Jamaica on a 56-acre

site, complete in 18 months, about the time the company will begin operating an 880,000 ton-a-year alumina refinery plant in Jamaica. Initial capacity of the dock will be about 100,000 or 200,000 tons per year...."

Problem: What soil bacteria, parasites, organisms, foreign to the U.S. will likely be brought into the U.S. by importation of this somewhat refined ore?

USE OF AIR-JETS AND AIR CURRENTS IN PROTECTION FROM WEATHER EXIGENCIES

Item: N. Y. Times, April 7, 1970, p. 32, "Open-Air Theaters in Winter Forecast." "Residents of Toronto may be able to watch ballet and theater in the open air in the heart of winter under a dome of snow.... Audiences would be protected from the elements by a current of warm air and warmed by radiant heat. Bernard Etkin, Professor of University of Toronto, presented a paper entitled 'Aircurtain Walls and Roofs-Dynamic Structure,' a proposal that energy might be substituted for mass in large architectural systems.... Experiment had already demonstrated that air can be used to provide walls and roof...."

Problem: Explore uses of air jets and air sheets, air currents, etc., for shelter from the elements. Explore uses of air currents for agitating and hence keeping open navigable and coastal waters otherwise frozen in winter. Can wildlife be enabled more successful winter survival? Can lanes through winter-frozen navigable waters be kept unfrozen economically, e.g. the tanker route to the Arctic, and deep water ports in North America and Europe? Leaving aside cost of capital equipment, large air-low pressure blowers, etc., are there situations in which energy requirements are economic when economic gains are taken into account? Can cities be kept at summer temperatures with sheets of air?

Air for Environmental Shelter

Item: Civil Engineering, March 1970, p. 50, "It is believed that air-supported cable roofs can be successfully used whenever a controlled environment is wanted. There appears to be no maximum span for applications of this type of roof; (but) it is not economically advantageous much below 150 ft. span...."

SURVEY OF CITY OF LOS ANGELES FOR PRONENESS TO DESTRUCTION BY EARTHQUAKES

Item: News Report, National Academy of Sciences, March 1970, "Earthquake Engineering: Protection for Society." "A National Research Council Division of Engineering Committee examining problems of earthquake-disaster-prevention, in a new report, Earthquake Engineering Research, National Academy of Engineering, 1969, catalogs major areas of ignorance. There must be better methods for assessing quake hazards at building sites.... There is not sufficient knowledge of the structural behavior of soils. Mathematical models are needed for study of structural stress in quakes. Dynamic properties of structures must be determined up to point of failure. Practical methods of quake-proof construction are needed...for dams, high-rise buildings, bridges and nuclear power plants.... Failures of large dams and nuclear power plants are potentially so catastrophic that the structures must be designed to withstand the strongest probable ground shaking...."

Problem: Survey existing buildings in Los Angeles and estimate damage from Richter 6, 7, and 8 earthquakes using best estimates presently available for soil and materials behavior.

WEATHER MODIFICATION BY CHANGING CO_2 CONTENT OF ATMOSPHERE

Item: American Scientist, January-February 1970, p. 18, "Though dire effects on climate of an increase in CO_2 have been predicted, they are far from being established. The cycle is not really understood; carbon dioxide may well prove to be the least objectionable or the only beneficial addition to the atmosphere from industrial sources. It is trying to talk about reversibility or irreversibility of CO_2 accumulation from industrial sources without mention of a green plant.... Atmospheric CO_2 is the source of almost all the carbon of organic compounds in our bodies. It is likely that CO_2 from industrial sources has actually increased the productivity of terrestrial vegetation since 1900, and that as fossil fuels are exhausted and industry goes to atomic power there will be a decrease, possibly ten percent, in agricultural yields...."

Problem: Analyze impact of change to nuclear power on agricultural and terrestrial vegetation and world food supply, through change in CO_2 content of world atmosphere.

DOME OVER MANHATTAN

Item: American Scientist, January-February 1970, p. 18, "Professor R. Buckminster Fuller desires a dome over the central part of Manhattan Island...made of shatterproof, one-way-vision glass, reinforced with wire and mist-plated with aluminum. Its edge would be supported some hundreds of feet above the ground so that only the highest buildings would rise into it. It would pay for itself in ten years by making snow removal unnecessary in this part of New York. It would be necessary to know the exchange of atmosphere through the space below the edge of the dome...to ascertain what gas production, including CO_2 would be permissible beneath the dome, given the amount of vegetation that midtown Manhattan could reasonably support.... There would also be the question whether a second dome should be constructed centered on Harlem...."

Problem: Analyze consequences of a dome over a city...both helpful and harmful; can artificial rainfall be provided, and is it needed, and will artificial controlled rainfall under such a dome provide smog control, temperature control, climate control; can artificial sunlight be provided. What are hazards for aircraft? What is lifetime for materials of the dome taking into account deterioration from ultra-violet light from sun, etc.? Will birds ever be seen under the dome? Will the dome stand against 150 m.p.h. hurricanes which sweep Manhattan periodically?

EXTERMINATION OF WORLD-WIDE GENUS RATTUS

Item: American Scientist, January-February 1970, p. 19, "It is uncertain what the outcome of the simultaneous extermination of all the species of the genus Rattus might be. In case of the common brown rat, R. norvegicus, it might be supposed that its elimination would lead to an enormous increase in populations in temperate maritime cities of the world of the black or house rat, R. rattus, which is a far more serious vector of plague. If both were eliminated, the other Oriental species, perhaps R. concolor, might follow commerce and invade our cities. Though we doubtless have more brown rats than we need in poor urban regions, their total elimination might lead to unsuspected and troublesome consequences...."

Problem: Analyze interaction of rats with society; do we need rats? What are likely long term effects of elimination of rat population? What is optimal speed of elimination and is it a practical possibility? Will weasels, minks, monkees, cats, snails, insects (roaches, centipedes...) take over the consequent vacuum?

Item: New Scientist, November 6, 1969, p. 278, "The problem of eliminating rabies." "Skunks are taking over as the chief suburban or even urban scavengers. Metropolitan Toronto, bigger and as densely populated as Birmingham, harbours about 1000 skunks to the square mile. The rural population can be anything up to 10 times higher. Skunks harbour the rabies virus...but how do you kill a large population of skunks?...."

Problem: Analyze beneficial aspects of an urban skunk population and recommend whether it should be killed or perhaps stocked for cities which presently have none. Skunks are eaters of insects and garbage, and in turn produce fertilizer. May domestic skunks in a high urban density be a cheap way to dispose of garbage and cockroaches?

Item: Science News, April 25, 1970, p. 409, "Resistant Rodents Develop." "Rats resistant to ordinary anti-coagulant poisons are

appearing beyond a cordon established by the British Government in an effort to prevent spreading of rodents, from a 1000 square mile agricultural area to the industrial towns of the West Midlands. The Infestation Laboratory has been unable to find a poison to use against the resistant rats. There are no reports of anti-coagulant-resistant rats having developed in the U.S....."

STUDY OF NATURAL OCEAN SLICKS; CARRIERS OF PESTICIDES

Item: the Apollo photographs show several examples of what may be natural ocean slicks.

Item: Chemical and Engineering News, March 2, 1970, p. 25, "Natural ocean surface slicks may transport pesticides around the world. Natural surface slicks off Florida contain 13 p.p.b. of chlorinated pesticides, although the surrounding water has less than 1 p.p.t. (part per trillion). The slicks, a compaction of the film of dissolved organic and inorganic molecules on the water surface, vary from a few meters to more than 100 meters in width and up to several miles in length. They may explain the occurrence of pesticide residues in penguins and the disappearance of pelicans from nearly all the U.S. seacoasts. Florida scientists have also uncovered inconsistencies in the tolerance of fish to chlorinated pesticides. Realistic limits for pesticide use can be obtained by preventing loss of pesticide as a vapor and by fixation to walls of containers, major reasons for inconsistent and inaccurate standards for pesticides...."

Item: N. Y. Times, April 8, 1970, "Senators Ponder Herbicide Perils; 2 Witnesses at Hearing See Threat to Public Health." "Herbicides used in widely marketed weed and brush killers are dangerous and might pose a threat to public health...widely used in Vietnam as a defoliant and in the U.S. as a brush killer...caused birth defects when fed to pregnant mice and rats...might upset ecological systems when used as defoliant...."

Problem: Survey all that is known of migration of oil slicks and seek evidence of ecological effects on fish, birds, seaweed, plankton, etc. Find best evaluated doses of pesticides and herbicides, and determine whether these doses are lethal for some species, non-injurious for others by surveying all available data. Determine whether there are wildlife (or artificially bred hybrid) species with good survivability against herbicides and pesticides at average dose rates. Can the disappearance of pelicans be attributed to

destruction of nesting sites along [illegible] coasts? Can nesting sites be provided on artificially create[illegible] off-shore islands built of old automobiles

SURVEY OF LAW FOR POLLUTION CONTROL

Item: N. Y. Times, April 9, 1970, p. 13, "Canada Acts in UN to Protect Arctic Against Oil Pollution." "Yesterday the Canadian representative presented to Secretary General Thant a notice that Canada had changed her position regarding jurisdiction over coastal waters by the International Court of Justice at the Hague. Long-standing Canadian acceptance of the World Court's jurisdiction was replaced by a new statement of the position. One paragraph says Canada recognizes the authority of the court but retains jurisdiction over disputes arising out of or concerning jurisdiction, or rights claimed or exercised by Canada in respect of the conservation, management or exploitation of the living resources of the sea, or in respect of the prevention or control of pollution or contamination of the marine environment in marine areas adjacent to the coast of Canada [extending 100 miles north of her land mass and 12 miles from her Arctic islands]...."

Item: N. Y. Times, April 9, 1970, p. 12, "Soviet Official Stresses High Cost of Pollution and Calls for Strong Protective Laws." "A Soviet conservation official calling for stricter laws to protect natural resources has declared that water pollution alone is costing the economy more than $6-billion a year...."

Problem: Survey existing pollution and conservation legislation, country by country, and recommend those laws which have successful function if they are applicable to the U.S. and do not as yet exist in the U.S. Recommend international law where similar laws in several countries indicate international agreement could be reached. Will a plan for indemnity payments between countries for pollution and spoilage of environment prevent quarrels such as that developing between Canada and USA?

Item: N. Y. Times, April 10, 1970, "U.S. Rejects Canadians' Claim to Wide Rights in Arctic Seas." "The U.S. today rejected Canadian claims to jurisdiction over extensive areas of arctic waters and said it would not recognize Canada's right to control American vessels on the high seas in the far north...in any area beyond 12 miles [of the coast]...."

EFFECT OF URBAN ATMOSPHERIC CO

Item: Science News, November 22, 1969, Vol. 96, p. 480, "Carbon monoxide makes up a large share of air pollution, but its physiological effects in small quantities are hard to pin down.. Although acute carbon monoxide poisoning is well understood chronic poisoning by low doses over prolonged periods of time is not. Chronic monoxide poisoning was first mentioned in 1869 when it was termed 'insanity of cooks', a consequence of bending over badly ventilated stoves. So far it appears that atmospheric concentrations of CO have a definite effect on the central nervous system and may aggravate heart disease...displaces oxygen in the (blood) hemoglobin forming carboxyhemoglobin (COHb). This lack of oxygen affects not only tissues but all organs of the body.... CO is the product of incomplete combustion and 78% is from motor vehicle exhaust. Metropolitan concentrations produce approximately 5% COHb in the blood, affects function and behavior, characterized by fatigue, headache, confusion, irritability, dizziness and disturbed sleep. Dr. Schulte noted variations in performance at levels as low as 2%, significant changes occur in pulse, respiratory rate, blood pressure, reflexes and psychomotor functions. Driver performance shows a decrement at 20 to 25% COHb; one study showed accident-involved drivers to have elevated COHb levels. In urban areas Dr. Dinman recommends the 8-hour standard for CO be dropped to 20 parts per million during the work day...exposures which produce 5% COHb could increase the rates of illness and death. The time CO remains in the atmosphere varies from 0.1 to 5 years, and it is estimated that CO would increase (in the atmosphere) 0.03 ppm per year. Though not understood it is believed that a true CO cycle exists in nature...."

Problem: Collect all available information on atmospheric CO, urban and rural, world wide; estimate trends in CO concentrations with time; estimate safe levels for health, driver competence, dog and cat response in urban areas, effects on urban plant life (what does CO do in interaction with chlorophyll and other biologically

important molecules?), what is effect on learning capability of school children, pre-school children? Are there palliative remedies, i.e. ultraviolet street lights to convert CO to CO_2 through ion-atom and ion-ion reactions; are there chemical palliatives, i.e., water jets throughout city centers spouting dilute solutions of iron salts able to complex CO and remove it from air?

Problem: What is the evidence for residence time of CO in the atmosphere, and is it different at different latitudes? Survey all that is known of reactions which may be responsible for removal of CO from the atmosphere.

Item: Technology Review, April 1970, p. 77, "CO at Sea." "F. L. Ludwig, et al. of Stanford Research Institute, found between Norfolk, Virginia, and Braemerhaven, Germany, marked variation in atmospheric CO at many stages of the voyage, from 0.4 ppm to 2.5 ppm. The CO concentration correlated closely with atmospheric changes, the highest concentrations corresponding with periods of subsidence in the lower levels of the atmosphere. The CO they measured was not simply the product of America's industry but was from the ocean itself, showing a significant source of CO in the ocean. The pollution sources of North America contribute to the CO in the air over the North Atlantic but the meteorological data support the premise that atmospheric CO levels in the North Atlantic are augmented by the natural ocean source.

POPULATION EXPLOSION FOR STARFISH AND ITS BIOLOGICAL CONTROL

Item: New Scientist, 30 October, 1969, p. 226, "Domesday for Coral?" "The giant starfish that has already destroyed about a quarter of the Great Barrier Reef in Australia now threatens tropical coral reefs throughout the Pacific. This could have catastrophic effects on fisheries and spell economic disaster for small isles and atolls of Oceania. Because reasons for population explosion are obscure there is no hope of effective control measures. For obscure reasons, Acanthaster planci is undergoing massive population explosion in widely separated areas of the Pacific...90% of the coral along 24 miles of Guam has disappeared...starfish up to 60 cm in diameter have been collected on Guam...coral is killed at an average rate of a square meter per month per starfish...over 70% of the reefs at Tinian have been wiped out...attacks are occurring throughout the Pacific, into the Indian Ocean and almost to the coast of East Africa. Its natural predators are the giant triton snail which eats the adult, the coral itself which consumes the larvae and the shark which eats both, but there is no evidence for change in the numbers of these creatures. Destruction of living coral reefs spells economic disaster for small islands and atolls, destruction of fisheries, and in time of land now protected by reefs...."

Problem: Seek throughout the aquariums of the world information on diet of predators (probably large creatures able to eat large adults) which already eat or can be trained to eat adult starfish and seed their young around every small island, atoll, and reef infested with starfish. Perhaps inroads on populations of whales, sea elephants, seals and sealions, sharks, etc. free swimming species which migrate and roam the world seas are responsible for uncontrolled population of starfish. If porpoises or trainable animals like them, eat starfish, perhaps herds of them can be taken from reef to reef to clean up starfish.

POPULATION EXPLOSION OF STARFISH AND ASSOCIATED DESTRUCTION OF REEFS

Item: Time, May 25, 1970, "Starfish Eaters." "German Zoologist Wolfgang Winckler presented a demonstration that the painted shrimp, Hymenocera elegans, feeds on starfish.... To Lee and Marth Talbot of the Smithsonian Institution the shrimp promise an answer how to cope with the crown-of-thorns, the starfish that is eating away vital coral reefs in the Pacific. Although the shrimp are not common around Australia's Great Barrier Reef and other threatened areas, they could be mass produced and set free in the ocean...[but] a sudden proliferation of painted shrimp might upset other balances in nature. What will shrimp eat for example after they have disposed of most of the starfish...."

Problem: Study economics of supplying artificial reefs made of compressed junked automobiles.

EFFICIENT USE OF CITY "GARDEN" SPACE PRESENTLY DERELICT

Item: New Scientist, 30 October 1969, "Growing Crops in Plastic Tunnels." "At the Lee Valley experimental horticultural station, Hoddesdon, Hertfordshire [in] a series of plastic-clad tunnels that look like ghostly Nissen huts, excellent vegetable and flower crops are being grown in unheated structures costing appreciably less than glasshouses, made by cladding galvanized steel hooped frameworks with 500 gauge polythene sheets [with] overhead spray lines. Temperatures and crop growth have been remarkably uniform. On sunny days the temperature has never been more than a few degrees higher than outside because the high infrared transparency allows most of the heat to be reradiated. When the outside temperature falls, condensation inside the polythene reduces infrared transparency, keeping the heat in...."

Problem: Even as urban crowding and urban slums become more and more severe, there remains land between slum buildings, and urban "gardens" which are sterile and barren and extremely uninviting. This land should be used for recreation and living space. Design polythene covers for city "gardens" which would indeed make them gardens and playgrounds for winter and summer alike, and make all land in cities useful for indoor and outdoor living, year around.

SEWAGE DISPOSAL IN FAR NORTH

Item: Science, December 5, 1969, p. 1234, "When military installations were built throughout Alaska after World War II, waste disposal was a salient point. The tragic aspect was complete reliance on criteria from temperate zones, with little understanding of the environment in which they were to be applied. Lack of design criteria for northern waste disposal has failure of waste disposal systems. Only relatively low quantities of raw wastes have kept pollution problems from becoming acute and highly publicized.... The problem may well become paramount as population pressures increase. Design criteria are not available--and this includes Scandinavia, Soviet Russia and Alaska--to build disposal systems [in] northern latitudes. Present plans call for adequate sewage and waste disposal systems by 1970... an estimate of $82-million for immediate needs with no reference to future...."

Problem: Study all available plans for waste disposal in severe cold climates, and invent a sewage disposal system for Alaska.

Item: (continued from above) "Kodiak Harbor has become so polluted from seafood cannery wastes that harbor waters can no longer be used in live holding tanks...crabs so held die. This condition has become acute in the 10 to 12 years that the king crab industry has been in Kodiak. Cook Inlet receives raw sewage from Anchorage and the Elmendorf Air Force Base. Fort Richardson's untreated wastes also end up in Cook Inlet by way of the Eagle River. Raw sewage from Juneau is discharged directly into Gastineau Channel, a poorly circulating inlet. Discharge of raw sewage into any available water is common practice. Pollution in the Chena River is evidenced by bacterial counts below Fairbanks that are 500,000 times those in the river above...."

OIL SPILLS IN COLD WATER

Item: Science, December 5, 1969, p. 1243, "Oil spills on waters of Cook Inlet are common, as the petroleum industry enters the production stage. This estuary has unique physical characteristics unlike any other water body in USA. The tides in Cook Inlet are second only to those in the Bay of Fundy. Currents reach velocities of 8 knots; the upper end of the inlet carries a high silt load from glacial streams; in winter the ice becomes several feet thick. How Cook Inlet will react to extensive oil pollution is unknown because our documented knowledge is inadequate to predict the behavior of the cold-water, silt-laden estuary...."

Problem: Study oil pollution in cold-water, silt-laden tidal estuaries, and recommend procedures to minimize the impact of ensuing problems on ecology and industrial shipping.

CONTROLS ON LOGGING

Item: Science, December 5, 1969, p. 1244, "Timber harvesting is ancillary to pulp mills.... This industry comes in for criticism from fishery biologists because logging affects the streams of a watershed. Stripping climatic forest from a watershed is traumatic... but there must be a compromise position.... Enough information is at hand to justify controls that prevent stream degradation. The principal obstacle is unwillingness of the loggers to accept that it is possible to log without ruining the watershed.... Ultimately effects of pulp mills on estuarine ecosystems are not known. In northern waters temperatures seldom arise above 10-20°C, which retards biological and chemical reactions. Dissolved oxygen is low because of ice cover during winter months; addition of oxygen-demanding wastes may trigger irreversible reactions which could interrupt the food chain and cause serious damage to flora and fauna...."

Problem: Design logging and paper pulp mill controls preventing ecological degradation for cold northern near-freezing waters, for temperate watersheds (Maine to North Carolina) and for semi-tropical regions (South Carolina to Florida)--keeping in mind the necessity of economic viability of the paper and lumber industries.

PROTECTION AND PRESERVATION OF TUNDRA LANDS

Item: Science, December 5, 1969, p. 1244, "In the Point Barrow area, the Navy and various other groups under contract for oil exploration have accumulated one-quarter million drums of human wastes because no feasible disposal method is available. What is going to happen as oil development expands with its attendant problems in the tundra ecosystem? How to provide ground transportation, how to dispose of human and petroleum wastes in this environment and how to prevent polluting the arctic waters when water is everywhere in the summer—these problems which must receive attention if damage is to be avoided.... True tundra north of the Brooks Range shows patterned ground, barren flatness, and extensive water surface between polygons; tracks are caused by tracked vehicles in winter and will remain (as scars) for many years.... The Arctic slope (of the Brocks Range) is the true tundra. Permafrost is continuous and deep. Precipitation is about 5 inches per year, but because of the short summer and frozen subsoil, the entire region is a morass from June through August when the surface soil thaws and creates a shallow, perched water table. Vegetation consists of prostrate willow; no upright trees grow...."

Problem: Design environmental and ecological controls for cities built on tundra. Consider use of heat pumps to pump heat out of the ground, thus keeping it frozen, and inserting the heat into the buildings above ground. Cost out use of heat pumps to keep soil frozen under pipe lines, airport landing strips, highways, warehouses, homes, office buildings, airplane hangars, bridge supports, telephone poles, power transmission line supports, radar installations, etc.

Item: N. Y. Times, May 24, 1970, p. 18, "Canada Presses Program to Prevent Damage to Arctic Lands." "An Arctic land-use program is getting under way. Preparations are being made for trails of new types of track vehicles designed to minimize damage to the fragile Arctic tundra. If track vehicles scrape off or compress the insulating top layer of moss on the tundra, the permafrost may melt, resulting in sinking of the soil as much as several feet. The phenomenon is known as thermokarst...."

ICE FOG IN FAR NORTH

At Fairbanks, Alaska, in winter, one jet taking off from the airport makes such an amount of ice fog as to close the airport for several hours. The morning traffic on the throughways makes similarly an ice fog so that visibility decreases to minimum. The problem worsens as traffic volume increases, and certainly will worsen with advent of the Boeing 747 jets and the SST jets.

Problem: Survey fog dispersal methods used in far northern airports, in Scandinavia and Russa, and those presently known in the USA, and recommend measures to be taken to ameliorate the problem in Alaskan airports. Can, for example, a network of hot water pipes laid around edges of airport runways sufficiently warm the adjacent air as to prevent fog over the airport? Should nuclear reactors be sited at northern airports as a source of warm water? The problem probably requires use of heat pumps to keep ground frozen under the airport.

HEAT POLLUTION IN CITIES

Heat is radiated from cities at a rate proportional to some power of the population, and heat flux per unit area proportional to some power of the population density. The heat comes, of course, from automobile engines, power plants, heating plants, manufacturing, sewage (bacterial heat) radio and television transmitted radiation, etc. and air conditioners.

Problem: At what population density and total population will a run-away power situation occur in which air conditioners must be increasingly more heavily powered in order to keep homes and offices cool, and in turn, by adding their heat to the environment cause the total heat production to become divergent. This problem obviously has a different solution for each city, depending on climate, local industries, kinds of housing, etc.

Problem: Survey methods to decrease per capita use of power in cities, e.g., better insulation in building construction, use of thermopane windows, more efficient elevators, air conditioners, refrigerators, lower horse-power motor cars, irradiation of sewage to prevent bacterial growth under the streets, etc. Recommend palliatives to the heat pollution problem in cities.